

**REMARKS**

The Office Action (1) rejected claims 25 and 26 as being indefinite, (2) rejected claims 12-17, 19, 21-23, 27, 30, 31, 33, 34, 37, 38 and 40 under 35 U.S.C. 102(e) as being anticipated by Lin et al. (U.S. 6,800,910 B2), and (3) rejected claims 18, 20, 24, 28, 29, 32, 35, 36, and 41 under 35 U.S.C 103(a) as being unpatentable over Lin et al. and further in view of various other prior art.

1. Regarding claims 25 and 26 as being indefinite, applicants have canceled claim 25 and made claim 26 dependant from claim 12, which is believed to overcome the examiner's rejection.

2. Regarding claim 12 under 35 U.S.C. 102(e) as being anticipated by Lin et al. (U.S. 6,800,910 B2), applicants have amended independent claim 12 as described below.

Specifically, applicants have modified claim 12 to cover a disclosed embodiment which is clearly not taught in Lin et al. Amended claim 12 covers a seed layer of silicon germanium deposited on an underseed layer of silicon. Due to the constraint of the underseed layer, the deposited silicon germanium is not relaxed, nor homogeneous, but has two different lattice constants, a parallel lattice constant in the directions parallel to the silicon underseed layer surface, and a greater perpendicular lattice constant in the directions perpendicular to the silicon underseed layer surface. As deposited, the silicon germanium seed layer follows the lattice constant of the underseed layer, and therefore the parallel lattice constant is the same as the silicon lattice constant. There is no such constraint in the perpendicular direction which is the free space, and therefore the perpendicular lattice constant is different from the parallel lattice constant. Further, since the

deposited silicon germanium is compressed in the parallel directions, the perpendicular lattice constant will be greater, and could be even greater than the relaxed lattice constant of silicon germanium, to compensate for the parallel lattice constant being smaller than the relaxed lattice constant of silicon germanium. Therefore the strained channel layer subsequently deposited on the seed layer will have a strained lattice constant of the perpendicular lattice constant.

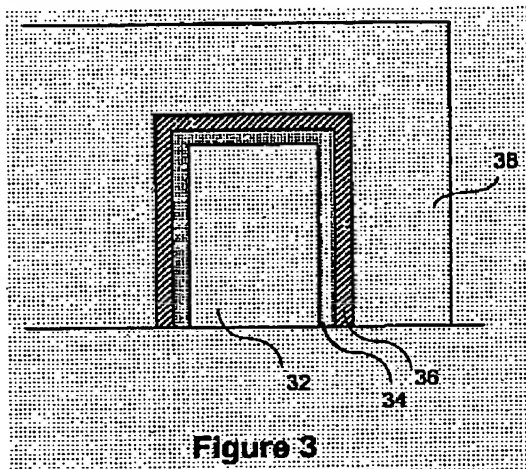
Thus, using an underseed layer, the strained channel layer of the present invention can achieve a higher strain due to a higher perpendicular lattice constant of the seed layer.

Applicants submit that Lin et al. discloses a finFET device having a homogeneous and relaxed silicon germanium as the seed layer. In contrast, the present invention further comprises an underseed layer of silicon before the deposition of the seed layer of silicon germanium. Due to the presence of the underseed layer, the silicon germanium seed layer is not homogeneous nor relaxed, but having a greater lattice constant in the direction perpendicular to the substrate surface. And therefore the channel layer deposited on the silicon germanium seed fin structure has a higher strain.

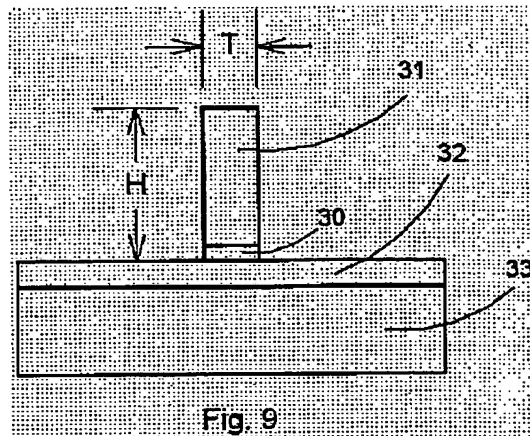
Applicants submit that the presence of the underseed layer provides unexpected benefits of a possible higher strain for the channel layer, and the simplicity of the fabrication processes by using a standard SOI substrate with an as-deposited SiGe layer, as compared to the disclosure of Lin et al., and therefore could not anticipated by Lin et al.

Regarding claim 38 under 35 U.S.C. 102(e) as being anticipated by Lin et al. (U.S. 6,800,910 B2), applicants submit that the present

invention strained silicon finFET device according to presently amended claim 38 is different from the strained silicon finFET device of Lin et al. in terms of device structure and also in terms of method of fabrication. See the following figures.



Lin et al., Fig. 3



The present invention, Fig. 9

As shown, the finFET structure of Lin et al. comprises a strained silicon channel layer 34 covering the seed fin structure 32. And thus the fabrication sequence comprises the patterning process of the seed fin structure 32 before the deposition of the channel layer 34 (col. 4, lines 38-43). In contrast, the present invention finFET structure according to claim 38 comprises a strained silicon channel 31 on top of the seed layer 30. And thus the fabrication sequence comprises the deposition of the channel layer 31 on top of the seed layer 30, and then the multilayer of channel 31 and seed 30 is patterned to form the fin structure. With different structures, the device characteristics of the two finFETs would be different. A further unexpected benefit of the present invention is the possible high device density since the

critical dimension T of the present invention finFET device is smaller than that of Lin et al.

Thus applicants submit that Lin et al. would not anticipate the embodiment of the present invention covered by amended claim 38.

Regarding claims 31 and 34 under 35 U.S.C. 102(e) as being anticipated by Lin et al. (U.S. 6,800,910 B2), applicants have canceled the claims.

2. Regarding the dependent claims, applicants submit that the cited art of Lin et al. fails to teach or suggest at least one element of amended independent claim 12 presented herein, namely the presence of an underseed layer, and fails to teach or suggest the variation in device structure and fabrication process sequence of the independent claim 38 of the present invention, namely the deposition of the channel layer before the patterning of the fin structure. Claims 15-21, 24, 26-30 and 39-40 all depend, directly or indirectly, from these independent claims. Accordingly, the dependent claims are allowable over Lin et al. for the same reasons as their respective independent claims, as described in detail above.

3. Regarding the section 35 U.S.C. 103(a) rejections, applicants submit that the combination of Lin et al. and Wolf et al. ("Silicon Processing for the VLSI Era"), Pham et al. (6,838,322), Dakshina-Murthy et al. (6,803,631), and Yu (6,475,869) would not render the present invention obvious.

Regarding claim 18 as being unpatentable over Lin et al., as applied to claim 12, and further in view of Wolf et al., applicants submit that both Lin et al. and Wolf et al. failed to teach or suggest the underseed layer of

claim 12, which provides unexpected benefits as discussed in (2) above, and therefore could not render the present invention obvious.

Regarding claim 20 as being unpatentable over Lin et al., as applied to claim 12, and further in view of Pham et al., applicants submit that both Lin et al. and Pham et al. failed to teach or suggest the underseed layer of claim 12, which provides unexpected benefits as discussed in (2) above, and therefore could not render the present invention obvious.

Regarding claims 28 and 29 as being unpatentable over Lin et al., as applied to claim 12, and further in view of Dakshina-Murthy et al., applicants submit that both Lin et al. and Dakshina-Murthy et al. failed to teach or suggest the underseed layer of claim 12, which provides unexpected benefits as discussed in (2) above, and therefore could not render the present invention obvious.

Regarding claim 24 as being unpatentable over Lin et al., as applied to claim 12, and further in view of Yu et al., applicants submit that both Lin et al. and Yu et al. failed to teach or suggest the underseed layer of claim 12, which provides unexpected benefits as discussed in (2) above, and therefore could not render the present invention obvious.

The Examiner rejected claims 32 and 36 under §103 as unpatentable over Lin et al. in view of Chu et al. (U.S. Patent No. 6,350,993). Claims 32 and 36 have been canceled.

The Examiner rejected claim 35 under §103 as unpatentable over Lin et al. in view of Murakami et al. (U.S. Patent No. 5,241,197). Claims 35 has been canceled.

The Examiner rejected claim 41 under §103 as unpatentable over Lin et al. in view of Candelaria (U.S. Patent No. 5,441,901). Claim 41 has been canceled.

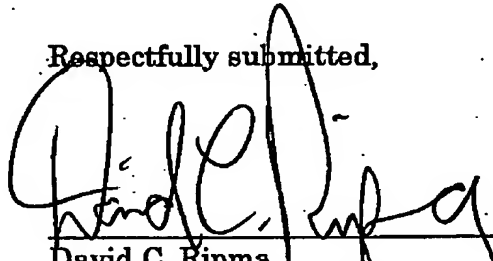
For the reasons set forth above, all claims remaining in the application are allowable over the cited references. The application is, accordingly, in fully allowable form.

This response is accompanied by a Petition for Extension of Time Under 37 C.F.R. §1.136(a) requesting a two-month extension, together with a deposit account authorization for the fee therefore.

In view of the foregoing, applicants request reconsideration of the application, as amended, and submit that the application is now in allowable form and should be passed to issue.

Date: 7/5/05

Respectfully submitted,

  
David C. Ripma  
Registration No. 27,672

David C. Ripma, Patent Counsel  
Sharp Laboratories of America, Inc.  
5750 N.W. Pacific Rim Blvd.  
Camas, WA 98607

Telephone: (360) 834-8754  
Facsimile: (360) 817-8505